

[Friday Afternoon, August 8]

SECTION XXIII
HISTORY OF MEDICINE
INDEPENDENT PAPER

SOME PATHOLOGICAL AND OTHER CONDITIONS
OBSERVED AMONG THE HUMAN REMAINS
FROM A PREHISTORIC ETHIOPIAN CEMETERY
IN THE SOUTHERN SUDAN, AFRICA

BY M. B. RAY, M.D. EDIN., AND L. H. DUDLEY BUXTON, B.A. OXON.

MATERIALS dealt with in this paper were excavated in a prehistoric Ethiopian cemetery by Mr. Henry S. Wellcome, and he has kindly permitted us to publish this brief paper in advance of his full report,

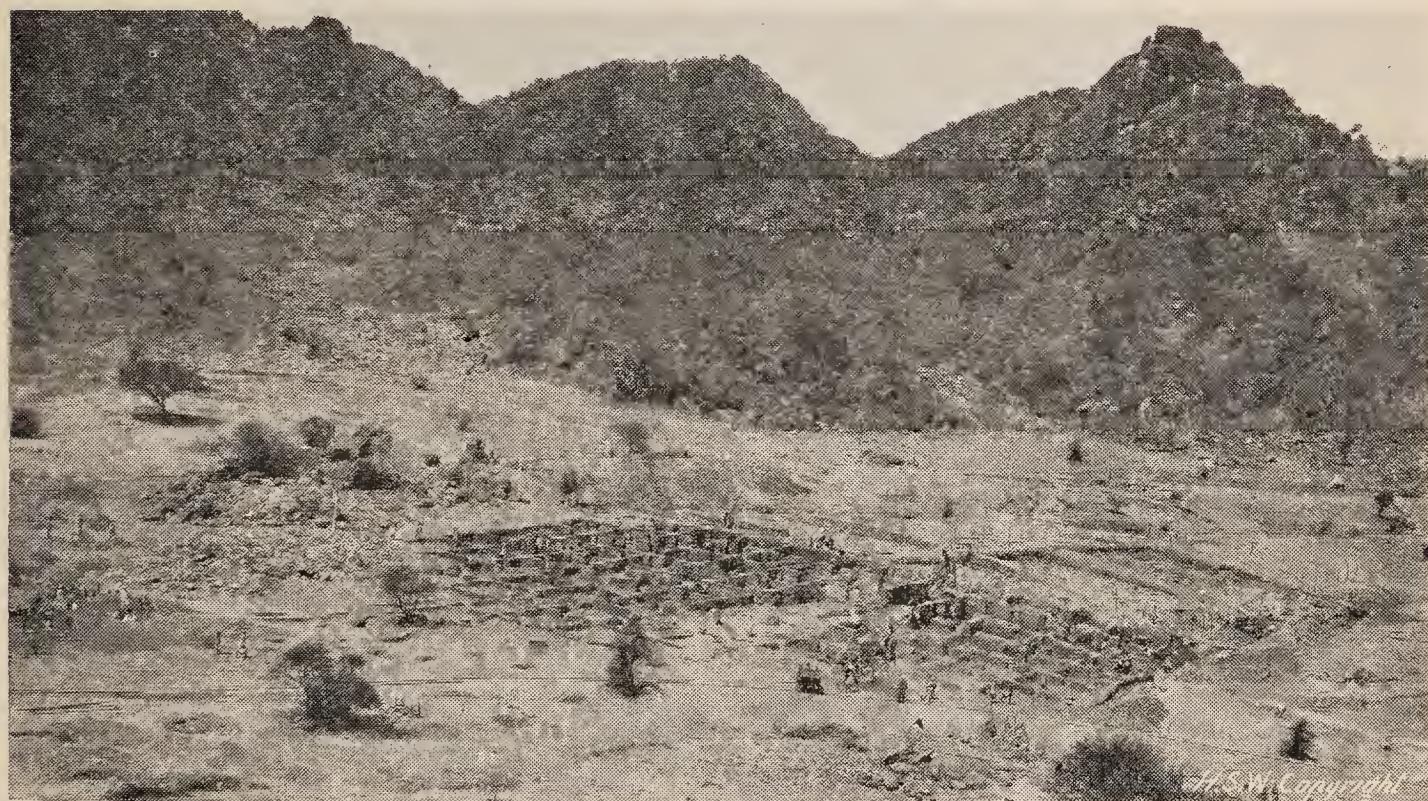


FIG. 1. Site of Mr. Wellcome's Archaeological Excavations, Gebel Moya.

which will appear later on. The cemetery lies in the southern part of the Gezira, *i.e.* the tongue of land between the White and Blue Niles (Fig. 1). It is in North latitude $13^{\circ} 30'$, roughly speaking about level with Aden, and is estimated to be about 35 kilometres west of the Blue Nile, 75 kilometres east of the White, and about 320 kilometres south of Khartoum. No completed survey of this region has yet been made.

Gebel Moya itself is a range of granite hills rising to about 250 metres above the plain; the cemetery is situated in a sort of basin up among the hills. In the very brief rainy season this hollow receives from the surrounding extensive watersheds quantities of water, which rushes in torrents down a precipitous rocky gorge to the south-west of the cemetery. All around the Gebel the plain stretches, as far as eye can reach, a thick tangle of often impenetrable acacia thorn, broken only by open plains with many isolated clusters of granite rock looking like islands in the sea, and occasional patches of cultivation. At the latter end of the dry season, that is towards the end of March, when all the reservoirs are dry and the wells very low, migrations to the Niles take place, although at Gebel Moya—as the name water-hill suggests—there are some wells yielding a meagre supply of brackish water, and indications are not wanting that at one time there was more water than at present.

The water conditions are of great importance when we come to consider the preservation of the bones and also the fact that we have such a large populated centre and a cemetery in one place.

Having thus explained the source of the water-supply for the former inhabitants of Gebel Moya, let us consider their food, as this matter is very important for our present purpose. Such evidence as we have so far discovered leads us to believe that on the whole, in matter of diet, little change has taken place up to the present day. The staple food of the modern inhabitants is dhurra cakes and milk; meat is eaten, but as far as could be judged, very sparingly. The dhurra, which is the most important article in the diet of the agricultural Nilotc peoples, is a cereal related to a common English weed, *Holcus lanatus*, the Yorkshire fog-grass. Dhurra is solely a rain crop at Gebel Moya, and the rains only last about six or eight weeks. It grows quickly, often over 6 feet high, the heads often being very large. The grain is round and about the size of a small dried pea.

Now our archæological evidence shows us that in former times a cereal of some sort, whether dhurra or sesame or some other grain, was extensively used, for some of the commonest objects discovered are millers and grindstones not dissimilar to those used at the present day in grinding the grain after it has been pounded in a mortar. Secondly, pits have been discovered in the cemetery site which were exactly similar to the pits which the present people use as granaries for storing the dhurra.

Next we have abundant osteological evidence that the ancient people possessed cattle, and indications that these latter played a very important part in their daily life. On the other hand, burnt bones, the invariable accompaniment of flesh-eating man, were few and far between, whereas at a different site, and probably of a different date, in the same range of hills, one of us examined the bones and found a very large proportion had been in the fire.

Turning now to a third point, without the consideration of which a discussion of the pathological conditions of any people would be incomplete,

let us try briefly to reconstruct the mode of life of the early inhabitants of Gebel Moya.

Numerous stone implements have been discovered, a large number of which are probably contemporary with the graves: These are mostly similar to those that would in Europe be called neolithic, and many exhibit considerable skill in the working and polishing of granite.

An extensive range of pottery, from very primitive to fine fabrics of beautiful types, has also been abundantly discovered. The people possessed ivory and ostrich eggs and made decorative lip-studs out of pottery and stone, sometimes wearing as many as seven in one lip. Special stress must be laid on this latter custom, as the wearing of lip-studs has considerable effect on the teeth.



FIG. 2.

So much then for general conditions. There are two special conditions, *i.e.* conditions which apply in particular to this cemetery, which must now be dealt with. First, in regard to date. Until the excavations are completed and the results fully studied, it is difficult at present to come to any definite conclusion on this point, but it is at least certain, from clearly datable evidence of objects found near the surface of the upper strata, that the latest of the burials can be dated about 700 B.C., and, from the fact that bodies are found in various lower strata to considerable depths, we may presume many of the bodies are of very remote antiquity (Fig. 2). Secondly, a noticeable feature of the bodies found is the large predominance of the females over the males; we have, however, discovered a sufficiently large number of males as to preclude the idea of a female cemetery. The explanation of this curious fact is uncertain; possibly wars may have been responsible for the destruction of the males away from home.

The pathology of the teeth of our specimens is of considerable interest. First, in regard to periodontal disease. We are very much indebted to Mr. F. J. Collier for his suggestions and help. Following Mr. Collier's

advice, we have classified the specimens under two headings: first, those in which the cause of the disease lies chiefly in the mechanical influence of food packing, especially in the first molar region. The alveolus in some cases has been so much absorbed that the teeth had fallen completely out of their sockets. In many of our specimens, the above condition was also accompanied by subcervical caries, which is well shown in the radiograph.

In direct contrast to these conditions, in a few cases we found that the subject was clearly suffering from general periodontal disease, accompanied by considerable rarefying osteitis. As might be expected from the comparative density of the two jaws, this condition usually first appears in the maxilla; indeed we very much doubt if any of the mandibles from Gebel Moya show evidence of general periodontal disease.

There are a number of specimens which show abscess cavities at the roots of the teeth, and in some cases the trouble has found an outlet not on the buccal surface of the maxilla, but in the antrum, or, in one example, the anterior part of the floor of the nasal aperture.

Crowding in the incisor region is not an uncommon feature; the chances of this are enhanced by the very large size of the central incisors—a racial characteristic. The crowding is sometimes masked by the extraction of the central incisors.

Where the extraction has not been performed, and in many cases where, owing to crowding, the operation has had little effect on the mouth, the front of the teeth present a very worn surface from the continual rubbing of the plug on the teeth.

Turning to the molar region, we find that in spite of the size of the jaws and of the teeth, the third molar suffers similar degeneration, and the case of an impacted molar is found as in modern conditions.

In comparing the general condition of the teeth in Gebel Moya specimens with those of modern Europeans, it is interesting to note that 'food packing' is much commoner in the Ethiopians than in Europeans; the latter, however, are much more subject to caries. The ancient inhabitants of Gebel Moya ground down the crowns of their teeth to a greater degree than any European in old age, though perhaps on the whole the ancient people under consideration kept their teeth better than we do; still, from what evidence we have, we may believe that they reached old age 'sans teeth, sans everything.' On the whole, however, they followed the Greek proverb, 'Those whom the gods love, die young.'

We have only observed one case of supernumerary teeth, that of a supernumerary premolar, and in one case the second premolar had three roots; this latter abnormality may of course have occurred more frequently without being observed.

We searched carefully for signs of osteo-arthritis, as there is evidence of the prevalence of this disease in Egypt at an early period, but we were only able to discover it in a very few cases; in one a fifth metatarsal, and in another one of the phalanges of the hallux, showed a characteristic

nodular appearance. In the case of the former example other bones of the same foot seemed to be affected.

One vertebra calls for special mention, as it is a particularly interesting case of arrested growth. The body of the vertebra (an eleventh dorsal) is almost crescent-shape owing to the fact that premature ossification of the growth centres took place. The skeleton was that of a young adult male, remarkable principally for its great size and for the muscular development of the arms.

We had expected to find considerable evidence of traumata on the bones, but as a fact we have few examples. Two depressed fractures are exhibited; they seem to be possibly due to a blow from a blunt instrument.

We found a certain number of fractured limbs. A very common form of injury among the ancient Egyptians, as Professor Elliot Smith and others have pointed out, is a fractured forearm. This was specially common among the women and is probably due to the effort to ward off the blow of a stick. The same form of injury due to the same cause is not uncommon among the modern Sudanese. However, it seemed unusual among the bodies we excavated. Fractured humeri occurred, and an example of a Pott's fracture calls for special mention as illustrating surgical skill of the ancient peoples, who probably got as good results as were attained in modern times until fractured ends were secured in apposition by mechanical means.

Calculi, vesical and biliary, were of common occurrence in the abdomina of the bodies we examined, and in some cases we were able to locate their exact position in the grave. A particularly fine specimen is illustrated (Fig. 3). This is very good because it shows the stones after they have escaped from the ruptured gall-bladder.

One skull was found with a large osteoma on the parietal bone. The tumour was hemispherical in shape, about two centimetres in diameter, and one centimetre high. We palpated the interior of the skull to discover if any pressure had been exerted on the brain, but the inner tablet showed no signs of abnormality.

Some of the specimens illustrating the various cases referred to in this paper are exhibited at the Historical Medical Museum.

Only a small number of the more than a thousand human remains discovered have yet been thoroughly dealt with. All, so far as their



FIG. 3.

condition will permit, are being carefully studied, and fully illustrated reports will be published as soon as practicable after the excavations are completed.

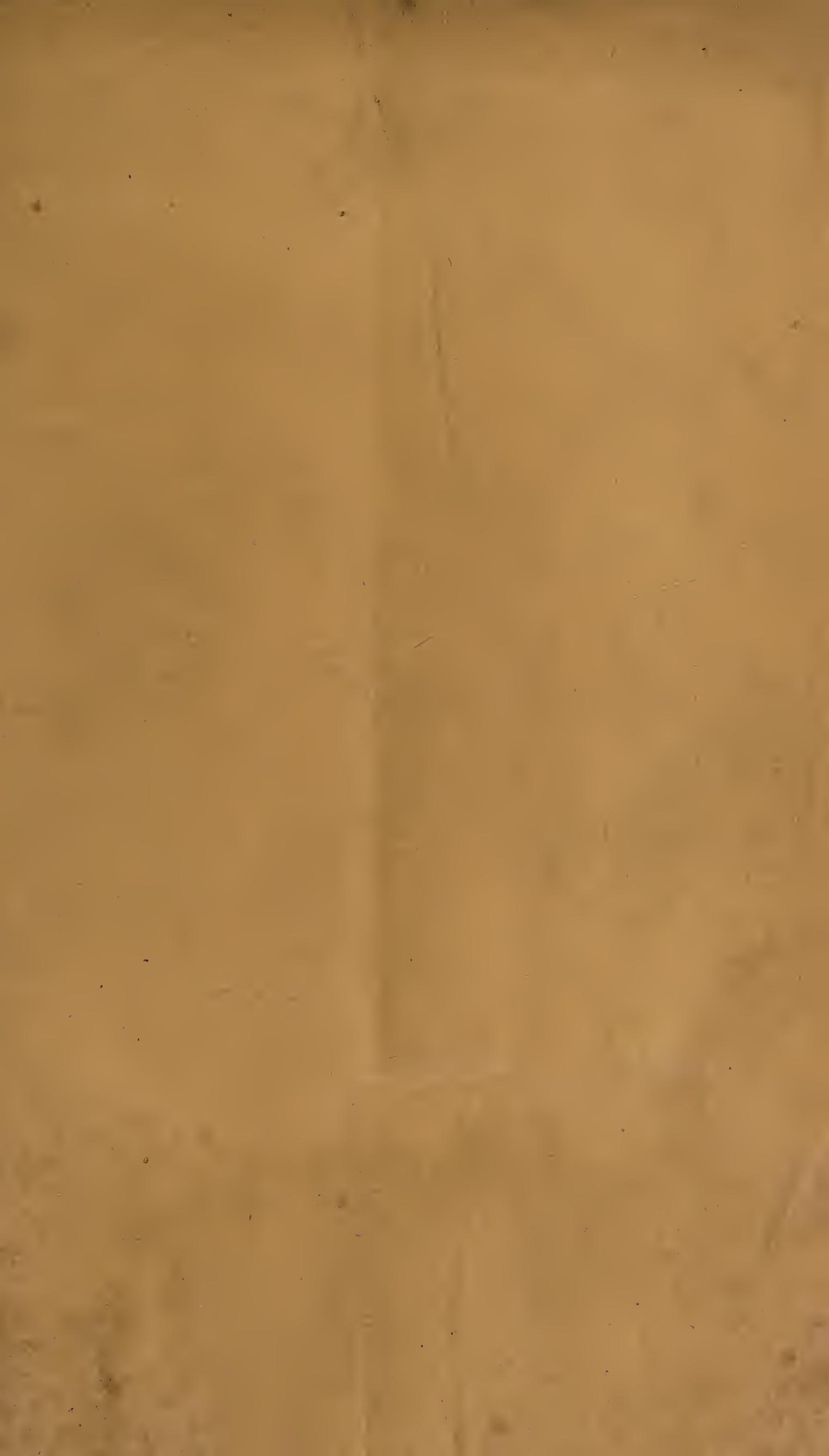
The burials thus far have mainly been on the border of the site, and where they have been most disturbed and exposed to damage. Mr. Wellcome is continuing his excavations, and when he reaches the centre of the site, it is anticipated that he will find still more interesting material in better condition, and which will throw some further light on pathological conditions as well as on the prehistoric races of Ethiopia, of which very little has hitherto been known.

Owing to the fact that our specimens, from being subjected alternately to torrential rains and extreme drought, were in a very brittle condition,



FIG. 4.

it was necessary to take special precautions for their preservation. As the result of a series of experiments, a special method was devised as follows: The skull or other bone to be treated was, while still *in situ*, cleansed as far as possible. It was then carefully scrubbed over with a paint-brush dipped in hot water. Then a piece of gauze roughly cut to the right shape was dipped in a strong solution of ordinary gelatine and spread over the surface of the bone (Fig. 4). In this way a covering was made which moulded itself on to the upper side of the bone. The specimen was allowed to dry—about half an hour. We found that if exposed too long to the tropical sun, the gauze cracked and peeled off. After raising the bone the under side was treated in the same way. We found that many skulls which would otherwise have fallen to pieces were by this method kept intact. The bones so treated stood the journey to England well, and the gauze is easily removed with warm water and a small brush.



Appendix to translation of Raynaud's memoirs on local asphyxia

APPENDIX BY THE TRANSLATOR.

St Thomas
London

A FEW words may be added by way of postscript to Raynaud's Memoirs on some of the additions which have been made to our knowledge of the disease in question, especially since Raynaud's final utterances.

Several cases of spontaneous symmetrical or asymmetrical gangrene, arising independently of obvious vascular obstruction, have been recorded in English and American medical literature. One of the most striking examples was a carefully reported case by Dr. Myrtle, under the title of Anæmic Sphacelus (*Lancet*, i., 1863, p. 602).

But Raynaud's researches were first brought prominently before English readers by Dr. Southey, in the *St. Bartholomew's Hospital Reports* for 1880 (case of symmetrical gangrene), and about the same time by Mr. Hutchinson in his Hunterian Lectures at the College of Surgeons.

The subsequent papers of Dr. Southey (case of local asphyxia, symmetrical gangrene, *Trans. Clinical Society*, xvi., 1883, p. 167; case of symmetrical gangrene, *Trans. Pathological Society*, xxiv., p. 286; of the Translator (three cases of Raynaud's disease, *Trans. of Clinical Society*, xvi., 1883, p. 179; and sequel, *Trans. of Clinical Society*, xviii., 1885, p. 307); of Dr. Colcott Fox (*Trans. Clinical Society*, xviii., p. 300); of Mr. G. H. Makins (case of spontaneous gangrene of toes in a child, *St. Thomas's Hospital Reports*, vol. xii., p. 155), and of several other English and American observers, have made the clinical features of this group sufficiently familiar.

Is there anything of importance to add to Raynaud's delineation?

I. The most noteworthy addition is the association of intermittent haemoglobinuria with some of the cases of local asphyxia and symmetrical gangrene.

There is a suggestion of this association in the history of a case recorded by Mr. Hutchinson so far back as 1871.* A woman, aged 30, had suffered during the winter with frequent shivering fits after exposure to cold. These attacks were accompanied or followed by general malaise, and the urine often became dark after them. One cold day after returning home, she found that her nose and left ear were quite black. During her stay in hospital small superficial sloughs gradually separated from the above-mentioned spots. She was liable to slight shiverings, during which she got icy coldness and purple congestion around the sloughing patches, but no blood or colouring matter appeared in the urine.

Mr. Hutchinson, in commenting on the above case, was inclined to the view that the history pointed to hæmatinuria, and that this and the limited localised gangrene of extremities, in the absence of malaria, had a common origin in exposure to cold, the patient's idiosyncrasy being taken into account.

In 1879 Dr. Wilks† had a boy aged 16 under his care, who, in consequence of some injury to the hip, had had profuse suppuration from the bursa between the glutæus maximus and the great trochanter. The patient, when transferred to Dr. Wilks's care, was cyanotic, and had a systolic murmur at the third right space. The edges of the ears became very blue, and the nose and toes likewise, but the tips of the thumbs and of several fingers became affected with definite gangrene, from which they slowly recovered.

The urine was at different times dark in colour, and gave the guaiacum test; granular casts and *débris* were present, but on several occasions no blood corpuscles could be found. At a later period, however, some blood corpuscles were present.

In Dr. Southey's first case‡ there was a history of the patient having passed black urine with some of her attacks, in which the fingers became numbed, black, and dead; but during her stay in hospital with symmetrical gangrene on the legs and attacks of local asphyxia of the fingers, though a trace of albumen is

* *Medical Times and Gazette*, 1871, vol. ii., p. 678. Gangrene of tip of nose and part of ear; iridoplegia.

† *Medical Times and Gazette*, 1879, vol. ii., p. 207.

‡ *St. Bartholomew's Reports*, xvi., 1880, p. 15.

noted as being present in the urine, there is no record of hæmoglobin.

In Dr. Southey's second case* of local asphyxia and symmetrical gangrene, there was for several days a true intermittent hæmaturia, provoked apparently by impressions of external cold to the surface of his body. It is noted that the blood was usually very apparent by its dark colour, and the obvious sediment it gave, *but its presence was at times only detectible by the guaiacum reaction*. Oxalates either preceded or accompanied the hæmaturia usually. It seems probable that this case was at times, at all events, one of hæmoglobinuria.

In one of the cases recorded by the translator,† the onset was marked by epigastric pain, and hæmoglobinuria was observed to occur within one or two hours from the beginning of the local asphyxia of the limbs. The dark urine only appeared once after a given attack. It gave the reaction with guaiacum, and presented under the microscope pigment and oxalates, but no blood corpuscles. The urine gave the spectrum characteristic of met-hæmoglobin. The translator pointed out the marked parallelism between typical cases of intermittent hæmoglobinuria and cases of Raynaud's disease, strictly so called, in which the paroxysmal character of the local asphyxia must be considered an essential "note" of the morbid phenomena. "They are not in a true sense periodic, but they are both paroxysmal." "Attacks in both affections have a remarkable relation to changes of temperature." "By far the greater number of cases of both are exclusively winter or cold weather affections, and if not exclusively they are primarily so, and if the attacks do not vanish, they notably diminish when the warm weather appears." "In both, the paroxysms may begin with yawning or with vomiting, and the extremities, as I can testify, may in the onset of an attack of paroxysmal hæmoglobinuria become extremely cold and blue." In both, the attacks may be accompanied by some abdominal pain, and both may be followed next day by sleepiness and by a certain sallowness of complexion and of conjunctivæ. It is the rarest event for an attack of intermittent hæmoglobinuria to occur when the patient is in bed, and this exemption also

* *Trans. Clin. Soc.*, xvi., 1883, p. 167.

† Dr. Barlow, three cases of Raynaud's disease. *Trans. Clinical Society*, xvi., 1883, p. 179. Also sequel to above, *Trans. Clinical Society*, xviii., 1885, p. 307.

obtains in the typical paroxysmal cases of Raynaud's disease. The translator also suggested as "worthy of investigation whether any other visceral paroxysmal affection could be ascertained like the temporary splenic enlargement which he had noticed in one of the haemoglobinuria cases." The analogy of Raynaud's disease with intermittent haemoglobinuria has been very frankly accepted by the chief English authority on the latter disease, viz., Dr. Dickinson, in the last published part of his work on kidney diseases.*

He holds that the difference may declare itself by little else than the more narrow limitation and the greater intensity of the superficial arrest of circulation in the one case than in the other. "Indeed the two conditions seem so to approach each other and mingle as to make it impossible to make a distinct demarcation between them" (p. 1187).

One of Dr. Dickinson's cases (Ellen Collingbourne), *vide* p. 499, is most important as bearing on this point, because the history of the case whilst under observation in the hospital shows that the typical attacks of intermittent haemoglobinuria were on one occasion replaced by a typical attack of paroxysmal local asphyxia affecting one hand, and unattended with the usual urinary affection.

Dr. Druitt† in the account of his own case shows that he suffered from obvious ague attacks, and also from distinct attacks of haemoglobinuria, related to cold, exposure, and to worry. These attacks were associated with very marked proneness to numbness, tingling, and blueness of the extremities, the blue patches at times being almost suggestive of imminent gangrene.

Dr. John Abercrombie‡ observed in one case that in certain attacks of local asphyxia, affecting chiefly the hands, the child passed urine which was of sp. gr. 1023, and contained about $\frac{1}{10}$ of albumen. It gave the guaiacum reaction, and microscopically oxalates, and some amorphous material were found, but no blood corpuscles.

Dr. Abercrombie holds that we are warranted in believing that

* "Renal and Urinary Affections," Part III. *Miscellaneous Affections of the Kidney and Urine*, 1885, p. 1185.

† Two cases of intermittent haematinuria. *Med. Times and Gazette*, April 19, 1873.

‡ "On Some Points in Connection with Raynaud's Disease." *Archives of Pediatrics*, Oct., 1886.

paroxysmal hæmoglobinuria and Raynaud's disease are the same thing, *i.e.*, that hæmoglobinuria is a symptom of the more general affection. He suggests even that the jaundice sometimes found after attacks of hæmoglobinuria (and also after attacks of local asphyxia) is the result of arterial spasm of the hepatic vessels.

The view which would now probably find more acceptance, is that the discolouration is a hæmatogenous jaundice, due to the breaking up of hæmoglobin in the blood stream elsewhere.

Several observers have pointed out that during a paroxysm of intermittent hæmoglobinuria, blood drawn from a cold extremity shows marked changes in respect to the corpuscles. They do not form rouleaux, and are markedly crenated, and granular masses appear in the surrounding serum. Murri,* of Bologna, believes that there is corpuscular destruction in the superficial vessels in which stagnation has occurred, and that arterial spasm, whatever its cause, is an essential factor in the disease. He holds that the corpuscles are broken up by the combined action of cold and carbonic acid.†

Boas‡ found that corpuscular changes could be brought about in the blood drawn from the finger of a patient who was the subject of paroxysmal hæmoglobinuria, by plunging the finger for a time into a dish of iced water; and Fleischer§ found that in one of his hæmoglobinuria patients a blister, which had been applied to the skin during an inter-paroxysmal period, gave evidence of the presence of hæmoglobin in its serum, after a paroxysm of hæmoglobinuria had occurred.

In the above observations no special regard has been made to the occurrence of local asphyxia of the extremities, but Dr. Myers|| has recorded a case which completes the group in the sense that there are blood changes, local asphyxia of extremities, and intermittent hæmoglobinuria occurring in the same patient.

A boy, aged 12 years, who was under the care of Dr. Cavafy for paroxysmal hæmoglobinuria, dated his first attack five years back when recovering from measles. About the same time, or

* *Dell Emoglobinuria da freddo.* Bologna, 1880.

† Quoted from Dickinson. *Vide* also lecture by Dr. Stephen Mackenzie, *Lancet*, 1884, i., p. 156.

‡ *Deutsches Archiv für Klinische Medicin*, 1883, p. 355.

§ *Berl. Klin. Wochenschrift*, 1881, No. 47, p. 694.

|| *Trans. Clin. Soc.*, xviii., p. 336.

soon after it, the ears were noticed to be very much cyanosed when the boy was chilly, and they ached much as he got warm. Subsequently gangrene of both ears set in, and this relapsed several times in successive winters. During the last two years the gangrene had stopped, but there was extreme cyanosis, tenderness, and aching of the ears on exposure. The attacks of paroxysmal haemoglobinuria had continued, being more frequent in winter than in summer. The attacks were typical in every respect. The blood was examined during the attacks, being taken from the cyanosed ears and from the hands. "The coloured corpuscles were fairly normal in outline, but sometimes had crenate edges; there was always an abnormal disinclination to form rouleaux, as Boas and others have noticed. Blood 'flakes,' as they have been called, were found, varying in colour from a deep reddish black to a thin transparent red, and in size from about four to ten times as large as a normal coloured corpuscle."

"On one occasion they seemed to be contained in a transparent envelope, and to be themselves somewhat granular, shading off into the colourless envelope."

II. With respect to the skin: (1) Although chilblains properly so-called are rare in Raynaud's disease, there are some cases of localised patches of subcutaneous mottling in which the deep purplish colour is permanent for a time and then gradually clears up, with or without pigmentation, which have a close connection with local asphyxia and symmetrical gangrene. Perhaps also the cases described by Dr. Cavafy (*Clinical Society's Transactions*, xvi., p. 43), as "symmetrical congestive mottling of the skin" are examples of an allied condition. Of the cases to which Dr. Weir Mitchell has applied the name of erythro-melagia, or the "red neuralgia" (vide *American Journal of Medical Sciences*, July, 1878, on "A Rare Vaso-Motor Neurosis of the Extremities") there are certainly some, which are examples of Raynaud's disease.

(2) Urticaria has been observed by Dr. Southey in one case to occur in the paroxysms of Raynaud's disease, and the same skin affection has been observed by Dr. Dickinson, Dr. Stephen Mackenzie, and Dr. Forrest in paroxysmal haemoglobinuria.

(3) There is a considerable number of observations bearing on the relationship of local asphyxia, symmetrical gangrene of

extremities, and scleroderma recorded by Ball, Vidal, Favier, and others.

Ball's case, reported by him as a new variety of scleroderma (*Bulletins, &c., de la Société Médicale des Hôpitaux de Paris*, 1872, p. 59), was that of a woman who for five years had suffered during the winter from hard yellowish patches on the extremities of the fingers, which subsided with the return of spring. Ultimately the fingers were permanently altered in that the extremities became cold, hard, somewhat unsensitive, and decidedly atrophied. The last phalanges were contracted in a state of semiflexion. The lesions were symmetrical, all the fingers of both hands being affected, but the thumbs were intact. Subsequently the toes were similarly affected. The patient was liable to crises from time to time, during which the finger reddened and became painful, then ulceration occurred and tardy cicatrisation with loss of substance. After each crisis the affected finger became a little more atrophied and deformed than before. There was no trace of scleroderma in other parts of the body.

This case was claimed by M. Raynaud as an example of the chronic form of local asphyxia and symmetrical gangrene. Dr. Colcott Fox states that in two of his cases of scleroderma, in which the hands were involved, the patients had been long subject to dead fingers, and one of them continued to have mild attacks of asphyxia of fingers after the onset of the scleroderma.

A very valuable case has been recorded by Dr. Finlayson (*Medical Chronicle*, vol. i., p. 316). The patient was a mason, aged 36, who presented well-marked scleroderma of hands, feet, legs, front of chest and abdomen, neck and face. This patient was much influenced in regard to the hardness of the skin by exposure to cold. He ultimately developed gangrene of fingers and toes, for which no gross lesion was found to account post-mortem.

In an unpublished case under the care of the translator the order of events was the reverse of that which obtained in Dr. Finlayson's case. A lady suffered for a considerable period with attacks of local syncope of the finger ends, which culminated in symmetrical gangrene of the tip of each index finger. From this she recovered, but afterwards slowly drifted into a state in which the fingers generally presented the atrophied tapering parchment-like character described by Raynaud, with some con-

tractions of the last phalangeal joints, whilst the chest walls became decidedly sclerodermatous.

III. With respect to the joints and structures surrounding joints, Raynaud has referred to fibrous ankylosis of the terminal phalangeal articulations and to thickenings along the processes of the palmar fascia in some of the cases, and the remarkable way in which especially the palmar thickenings may clear up (*vide* New Researches, p. 160). This was strikingly illustrated in an unpublished case under the care of the translator. But it would appear that occasionally the larger joints may become temporarily involved. Thus in Dr. Southe's second case (*Clin. Trans.*, xvi., p. 174), whilst under observation, effusion was noted to occur during one of the attacks in both knee-joints. No details are given as to the duration and character of the joint affection, but in the remarkable case recorded by Dr. Weiss ("Ueber Symmetrische Gangrän," *Wiener Klinik*, Oct., Nov., 1882) there is a long series of observations on these points. In the early attacks only the finger joints suffered, but subsequently the left knee, the right elbow, the right shoulder, and the right wrist were affected.

Weiss thus sums up the clinical characters observed :—There was effusion in joint cavities, and infiltration of connective tissues above and below the joints. Once there was synovitis of the metacarpo-phalangeal joint of the right middle finger, followed by tenosynovitis of the flexor tendons of this finger. On one occasion there was effusion into the knee-joint, associated with exudation into the cellular tissue of the thigh and knee. Sometimes the joint effusion was preceded by pain, in other cases it was painless. The swollen joints and the swelling of the soft parts were not specially tender to pressure. The skin was only reddened once, viz., in the case of effusion into the shoulder joint. The temperature was not raised at the outset, and the course throughout was afebrile. In most cases absorption was rapid, and the constituent parts of the joints returned completely to the normal state. Weiss is inclined to bring these transitory joint affections "into line" with the benign forms of arthropathy described by Charcot and others as occurring in many cerebro-spinal diseases, looking upon the central affection in his case as a temporary anæmia of the hypothetical trophic joint centres in the cord.

IV. Eye Symptoms.—No further definite example of amblyopia alternating with attacks of local asphyxia in limbs (as in Case I., *New Researches*, p. 155), or coinciding with such attacks (as in Case II., p. 164), has been recorded. But Weiss's case, to which reference has already been made, presented some remarkable eye phenomena, referred by him to the involvement of the cervical sympathetic. These phenomena occurred in attacks which were interposed between some of the frequent seizures of symmetrical gangrene of the fingers, and although these attacks had special features, there were other points in which they conformed to the usual order of events. For several days the patient had retraction of the eye-ball, narrowing of the palpebral fissure, contracted pupil with no reaction to light, and a slight degree of ptosis. There was at the same time reddening of the zygomatic region and of the external ear of the same side, some elevation of temperature, and some hyperidrosis. As the attack cleared up, a slight degree of superficial gangrene of the skin of the zygomatic region appeared in the shape of some small patches of first brown then blackened epidermis, which ultimately separated. The patient had several such attacks, affecting the left side of the face and left ear, and some also affecting the right side, and at times both sides simultaneously, but only on the left side were the eye phenomena marked. On the left side of the face there remained subsequently a slight degree of atrophy.

Weiss was inclined to explain the eye phenomena by some central cause, *e.g.*, ischaemia of the cilio-spinal region of the cord.

In Mr. Hutchinson's case, mentioned at the outset of this appendix, of gangrene of the tip of the nose and tip of the left ear, there was also iridoplegia on the left side. The pupils were large and unequal, the left being bigger than the right and motionless, both on exposure to light and on accommodation efforts. There was contraction to Calabar bean, and the vision was good. Syphilis was suspected in this case.

V. Cerebral Symptoms.—Some of Raynaud's cases were markedly hysterical and chlorotic (VIII., IX., pp. 43, 54), and one of them (XIX., p. 89) was admitted to the Salpêtrière on account of "epileptiform attacks, with notable alteration of intelligence and incoherence of ideas."

In Dr. Southey's third case, a boy aged 9 (*Clin. Trans.*, xvi.,

p. 167), there were curious maniacal attacks in the early part of the illness, when gangrene of one finger tip was already present.

Dr. Southey has informed the translator that he has since the publication of the above seen several examples of Raynaud's disease in "asylum cases," and Dr. Wiglesworth's case (*vide postea*), in which the disease occurred in a young woman who was the subject of epileptic dementia, is another illustration of this. In an unpublished case under the care of the translator the patient, a middle-aged woman, during a slight remission of her attacks of local asphyxia, became the subject of delusions which were always worse in the evening. The possibility of her requiring to be removed to an asylum was considered, but she ultimately made an excellent recovery.

In Weiss's case there occurred during one phase of the illness a period during which the patient had markedly ataxic aphasia, without any paralytic manifestation whatever. For other cases in which Raynaud's disease occurred in patients who were suffering from grave organic disease of the nervous centres, *vide* next section.

VI. Pathology and Etiology.—Consideration of his later examples, and of others akin to them, shows that some of the points upon which Raynaud laid great stress in his early typical cases cannot be maintained in an absolute sense. Amongst these points are (1) the bilateral symmetry, (2) the successive stages of the affection, (3) the depth of the gangrene. There have been several undoubtedly paroxysmal cases in which some of the attacks were bilateral and others entirely *unilateral*. The stages of the affection in a given case are not always as Raynaud stated them—viz., first local syncope, then local asphyxia, then gangrene. Several cases have been observed in which there was no stage of preliminary ischæmia, but in which the local asphyxia was the first event. Finally the gangrene produced has occasionally in cases of Raynaud's type been observed to extend to the deeper structures, and even involve the end of a limb, instead of being limited to the true skin, or the extremity of the unguial phalanx, as described in the text (p. 113).

Relation to Ague.—It is strange indeed that the possibility of any connection between the disease which he described and malarial fevers does not appear to have been considered by Raynaud. In two of his earlier cases (VI. and VIII., pp. 40,

43) the symptoms of local asphyxia of limbs appeared about a fortnight after recovery from tertian ague, and the first of his later cases (p. 155, *New Researches*) had suffered from ague thirty years previously.

In the article on gangrene (p. 679, *Dict. de Méd. et de Chir. prat.*) Raynaud says that "although after repeated attacks of intermittent fever œdema of the limbs, with or without thrombosis, may often be observed, no examples are known of gangrene special to the malarial cachexia." Since the publication of Raynaud's memoirs several cases of local syncope, local asphyxia, and gangrene have been recorded as occurring in persons who either were suffering at the time or had suffered from ague. The most complete review of this subject has been given by Petit and Verneuil (*Rev. de Chirurgie*, 1883, pp. 1, 161, 432, 699). The cases of gangrene described by them are very miscellaneous in character, some of them resembling the form which occurs as a complication of various exanthemata, and not strictly comparable with Raynaud's type, but there are others which seem to conform to it in that the gangrene occurs in young subjects, and is symmetrical, terminal, dry, and circumscribed. It is also clear that in some of the cases recorded, both of local asphyxia and of gangrene, there was a definite response to the use of quinine. M. Mourson, in his second memoir (*Arch. de Méd. Nav.*, 1880, p. 340) on this subject, places the local asphyxias in malarial subjects in juxtaposition with some of the anomalous central and peripheral nervous affections which occur as sequelæ and "larval" forms of ague, and he broaches the theory of melanæmic deposits in the vessels of the cord, &c., as a possible agent of their production.

It is of importance to note the evidence which has been brought by Dr. Dickinson and others in support of the malarial origin of some of the cases of the allied affection, intermittent hæmoglobinuria.

Relation to Syphilis.—Two of the examples quoted by Raynaud (XVI., XVII., pp. 85, 87) were patients who had suffered previously from acquired syphilis. This has also obtained in some of the subsequently reported cases; and in a remarkable instance of symmetrical gangrene recorded by Dr. Henry Humphreys, the patient was a syphilitic child. The obvious objection arises that in these cases there may have been present some syphilitic

endarteritis capable of causing vascular obstruction; and in future observations this question ought to be carefully investigated. It is noteworthy that both Boas and Murri mention syphilis along with ague as a probable determining factor in the production of haemoglobinuria (*vide* paragraph I.).

Relation to Peripheral Neuritis.

Raynaud's cases in respect to post-mortem evidence are defective, except in a negative sense, as putting out of question any naked-eye vascular lesions adequate to explain the local asphyxia or the gangrene. The investigations which of late years have been made into the lesions of peripheral nerves have been extended to some cases of gangrene. Whether these cases would have been accepted by Raynaud as clinically conforming to his type is a question; but they deserve consideration. The first was recorded by Mounstein (quoted by Hochenegg, *Ueber Symmetrische Gangrän und Locale Asphyxie*. Vienna, 1886, p. 35). The patient was a man, aged 51, for whom amputation of the right leg in the upper third was performed on account of gangrene of the foot, which had commenced two months previously. A week after the amputation was performed the patient succumbed, with a high temperature. His urine was natural. The gangrene had led to the separation of the first, second, and fifth toes, whilst the third and fourth were isolated; but the skin over all the toes was involved in the gangrenous process as well as that covering the heel, the inner side of the foot, and the dorsum. The vessels generally of the lower extremity were free from abnormal contents; only in the capillary vessels adjacent to the gangrenous focus were microscopic hyaline thrombi present. The posterior tibial artery showed many calcareous plates, but no thrombi adherent to them. The posterior tibial nerve was greatly thickened in its lower part; microscopic investigation showed great wasting of the myelin with collapse of Schwann's sheaths, and chronic inflammatory proliferation of the interstitial connective tissue, especially in the parts close to the gangrenous area. The nerves in the left sound lower limb showed similar changes to those in the gangrenous limb.

The nerve roots of the lumbar region were only affected with neuritis on the right side.

Brain and cord were markedly anaemic, and the examination of the viscera gave negative results.

The clinical history of this case is too meagre to allow of its being definitely placed in Raynaud's group, but the double-sided affection of the nerves, more extensive on the gangrenous side, is very suggestive. The cases recorded by Pitres and Vaillard (*Archives de Physiologie normale et Pathologique*, 1885, p. 106) are given much more fully. The first was that of a young woman, aged 24, of feeble intelligence from childhood, but who at 18 began to suffer from tremors and stiffness of limbs, until at length walking became impossible; the lower limbs passed into a state of extreme contracture, and the patient was bed-ridden and demented. After a time the feet were noticed to be cold, blue, and insensitive; they gradually became gangrenous; the left foot underwent spontaneous amputation, and the right was all but separated. Numerous eschars appeared in various parts of the body; many of these suppurred, and the patient died from exhaustion. On post-mortem examination the tibial arteries were seen each to terminate in a cicatricial *cul de sac*, which was surrounded by fleshy granulations. In no part of the arteries of the lower limbs were adherent thrombi found, only here and there soft clots. The aorta and its branches and the veins of the limbs were healthy, and the examination of the viscera gave negative results. In the nervous system there was found chronic hydrocephalus of the lateral ventricles, and some undue adhesion of the pia mater to the cortex of the hemispheres, and the skull was greatly thickened. There was a slight diffuse sclerosis of the dorso-lumbar part of the cord affecting the whole of the antero-lateral columns and the whole of the posterior columns except their anterior fifth. The spinal ganglia and nerve roots, so far as they were examined, were natural. The principal nerve trunks were carefully examined throughout the body. Those of the upper limbs were normal, and the nerves of the thighs were also normal; the anterior and posterior tibial of both sides presented changes of varying extent, but which were fairly symmetrical. The changes consisted in extensive atrophy of nerve fibres with empty sheaths, presenting numerous nuclei and, at long intervals, varicose dilatations, which contained masses of granular protoplasm and drops of myelin. Between the fibres in many places was found abundance of leucocytes.

infiltrated with small granules, and having the aspect of Gluge's corpuscles.

The second case is that of an old woman, aged 56, a rag gatherer, who had been subjected to great hardships, and for six months, along with a sensation of considerable fatigue, had found that in walking she no longer felt the soil on which she trod. Two months before her admission to hospital, bullæ formed on the soles of her feet. These she pricked, and they gave her little trouble. About the same time she began to suffer with obstinate diarrhœa. Three days before admission the feet became swollen, painful, and covered with reddish patches on the dorsal surface. Fresh bullæ formed on the feet; they were perfectly cold, and anæsthesia on the left side extended up to the ankle, on the right side to the middle of the tarsus. The line of separation formed at this level on both sides, but the patient died from exhaustion and diarrhœa before actual separation had taken place. Post-mortem examination showed neuritis of the plantar and tibial nerves, but the vessels of the limbs were natural, and the brain, spinal cord, and viscera were also natural.

The authors of this memoir meet the objection, that in the above case the neuritis might have been consecutive to the gangrenous process by recording the results of an examination of peripheral nerves in a case of gangrene of embolic origin. The nerves in the gangrenous extremities were found to be normal throughout.

Thus Pitres and Vaillard are inclined to regard the peripheral neuritis in their cases as the cause of the gangrene, and they hold that most of Raynaud's cases of gangrene were of like origin.

Dr. Wiglesworth has recently recorded a case of very extensive peripheral neuritis in a woman, aged 26, who was the subject of epileptic dementia and of chronic Bright's disease, and who had suffered repeated attacks of spontaneous gangrene of fingers and toes (*Path. Trans.*, 1887, p. 61).

Hochenegg (*Über Symmetrische Gangrän und Locale Asphyxie*. Vienna, 1886), whilst admitting the soundness of the conclusions of Pitres and Vaillard on their own cases, disputes the universality of their propositions. He reports a case at considerable length of a man, aged 51, who developed gangrene of the left hand independently of vascular causes. The post-mortem examination

showed chronic hydrocephalus and syringomyelia. In regard to the peripheral nerves only a slight degree of atrophy was found, which was held to be secondary to the cord lesion. Hochenegg maintains that the gangrene was caused by the central lesion, but in view of the existence of the nerve changes, slight and non-inflammatory though they were, this conclusion seems hardly satisfactory.

We must wait for the "last word" which further investigations will justify as to the part played by peripheral neuritis in the *final stage* of Raynaud's disease, viz., that of symmetrical gangrene, and there will still remain the question as to how the peripheral neuritis is itself initiated. But it is safe to assert that *peripheral neuritis alone* is quite inadequate to explain the early and paroxysmal stages of the affection. For the cases which only become manifest during exposure to cold, and which during the intervals return to absolutely normal conditions, no better explanation is yet forthcoming than Raynaud's hypothesis.

VII. *Treatment.*

In the treatment of the cases which go on to gangrene of the limited form which Raynaud describes, the expectant method which he recommends has been repeatedly justified; but with deeper involvement of tissues amputation has been performed with advantage as for other forms of spontaneous gangrene. The use of the constant current, as recommended by Raynaud, has been adopted with advantage by several observers in cases of local asphyxia. The method which has been found most satisfactory by the translator in four separate cases has been the following: immerse the extremity of the limb which is the subject of local asphyxia into a large basin containing salt and water; place one pole of a constant current battery on the upper part of the limb, and the other in the basin, thus converting the salt and water into an electrode. Employ as many elements as the patient can comfortably bear, make and break at frequent intervals so as to get repeated moderate contractions of the limb. In a typical paroxysmal case, if two limbs be similarly affected, it will be found that the limb which is subjected to the above treatment will more rapidly recover than the one which is simply kept warm. It will also generally be found that the patient can

tolerate the above mode of stimulation much more readily than he can bear friction with the hand, and that the use of galvanism in the way indicated, or by simply "painting" with two sponge electrodes, held on the limb at a short distance from each other, will so far diminish the pain that the patient becomes able to bear shampooing afterwards.

In chronic cases, although the relief is not so obvious, there can be no doubt at times as to the value of this measure in improving the nutrition of the limb, and in keeping the threatened gangrene at bay. Even when gangrene in the limited form which Raynaud describes has supervened, galvanism to the parts above and around may be tried with advantage.

Shampooing ought certainly to be employed in conjunction with galvanism, especially in the chronic cases in which the extremity of the limb undergoes a degree of atrophy, or in which contractions and fibrous ankyloses take place. Strange as it may seem, the local application of cold is occasionally more comforting during the painful paroxysms than heat. Dr. Southey found in one of his cases that an ice bag applied over the painful extremity gave considerable relief.

In addition to diffusible stimulants and the whole category of sedatives, nitrite of amyl has been recommended on theoretical grounds with a view to relax spasm of arterioles. The translator tried it many times, both in a paroxysmal case, and in chronic cases, but with only negative result.

